

**INDIANA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS MANAGEMENT**

**ACCEPTANCE PROCEDURES FOR HMA SURFACE MIXTURE
COARSE AGGREGATES FOR ESAL $\geq 10,000,000$
ITM No. 221-12P**

1.0 SCOPE.

- 1.1** This method sets forth the acceptance procedures to be used when Aggregate Producers request that coarse aggregates be evaluated for use in HMA surface mixtures with ESAL $\geq 10,000,000$.
- 1.2** HMA surface mixture aggregates are specified for use under certain traffic ESAL loading conditions to obtain skid-resistant HMA surface courses.
- 1.3** Coarse aggregates tested in accordance with this procedure shall be Polish Resistant Aggregates in accordance with ITM 214 or otherwise approved by the Department.
- 1.4** This method is a two part process. Part One requires a comparison of a HMA surface mixture with the proposed coarse aggregate to a HMA surface mixture with an approved steel furnace slag coarse aggregate using the Circular Track Meter (CTM) in accordance with ASTM E 2157 and the Dynamic Friction Tester (DFT) in accordance with ASTM E 1911. The CTM and DFT values are used to determine the International Friction Index (IFI) in accordance with ASTM E 1960. If the results of the comparison indicate that the HMA surface mixture with the proposed coarse aggregate has an IFI value equal to or greater than the IFI value of the HMA surface mixture with steel slag then Part Two may be initiated.

Part Two requires that a test section of HMA surface mixture using the proposed coarse aggregate and a control test section of HMA surface mixture using steel slag be placed on a contract. The steel slag may be blended with an approved dolomite or polish resistant aggregate for the control test section. Acceptance of the coarse aggregate is made on the basis of an evaluation of friction test data obtained after two years of exposure to traffic; however, an aggregate may be accepted after one year of exposure to traffic at the discretion of the Department.

- 1.5** The Aggregate Producer will be required to maintain a warranty bond on the HMA surface course of the test section using the proposed coarse aggregate. The bond amount shall be sufficient to replace the test section with material satisfactory to the Department. Upon opening the test section to unrestricted traffic, the warranty bond will be in effect for a total of two years. The warranty bond is required to be properly executed by a surety company satisfactory to the Department and be payable to the State of Indiana. Appendix A shall be used for the warranty bond.

- 1.6** If within two years of exposure to traffic, the average friction number of the proposed aggregate is less than the average friction number of the approved steel slag, the Department will evaluate the test section to determine if a problem exists. If remedial work is required, the Aggregate Producer shall conduct the work at no cost to the Department. If the Aggregate Producer cannot conduct the remedial work within a timely manner, the Department has the option to execute the warranty bond and have the remedial work conducted by other forces.
- 1.7** This procedure may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 REFERENCES.

2.1 AASHTO Standards.

- T 11 Materials Finer than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing
T 27 Sieve Analysis of Fine and Coarse Aggregates

2.2 ASTM Standards.

- E 274 Skid Resistance of Paved Surfaces Using a Full Scale Tire
E 524 Smooth Tread Standard Tire for Special-Purpose Pavement Skid Resistance Tests
E 1911 Measuring Paved Surface Frictional Properties Using the Dynamic Friction Tester
E 1960 Calculating International Friction Index of a Pavement Surface
E 2157 Measuring Pavement Macrottexture Properties Using the Circular Track Meter

2.3 ITM Standards.

- 207 Sampling Stockpiled Aggregates
214 Acceptance Procedures for Polish Resistant Aggregates

3.0 TERMINOLOGY. Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101.

4.0 SIGNIFICANCE AND USE. This ITM shall be used to evaluate coarse aggregates for use in HMA surface mixtures for ESAL $\geq 10,000,000$ applications.

5.0 APPARATUS.

- 5.1** Dynamic Friction Tester in accordance with ASTM E 1911
- 5.2** Circular Track Meter in accordance with ASTM E 2157
- 5.3** Circular Track Polishing Machine. This device consists of three rubber tires attached to a rotating plate that travels at approximately 47 revolutions per minute resulting in approximately 141 wheel passes per minute. Water is sprayed on the mixture slab surface to remove debris generated during polishing. A total load of 150 lbm is applied through the tires to the surface.
- 5.4** Friction vehicle and instrumentation in accordance with ASTM E 274
- 5.5** Smooth Tread Standard Tire in accordance with ASTM E 524

6.0 GENERAL REQUIREMENTS.

- 6.1** Each Aggregate Producer requesting to have a coarse aggregate tested in accordance with this procedure shall do so in writing to the Manager, Office of Materials Management. Information concerning the type of material, and ledge numbers, if applicable, shall be included.
- 6.2** The steel slag material used in the control test section shall be obtained from a Certified Aggregate Producer.
- 6.3** Testing shall be conducted by the North Central Superpave Center. The cost of shipping and testing of the coarse aggregate shall be the responsibility of the Aggregate Producer.
- 6.4** Friction testing of the test sections will be conducted by the Department at no expense to the Aggregate Producer.
- 6.5** Approval of the coarse aggregate for use in HMA surface mixtures for ESAL \geq 10,000,000 will be based on results from both Part One and Part Two of this procedure.

7.0 SAMPLING.

- 7.1** Sampling of the coarse aggregate and steel slag shall be in accordance with ITM 207 in the presence of the Department.
- 7.2** The samples shall be sufficient in quantity to yield a minimum of 100 lbm of material that is passing the 1/2 in. sieve.

7.3 The samples shall be washed and decanted in accordance with AASHTO T 11.

8.0 PROCEDURE (PART ONE)

8.1 Mix Design

8.1.1 Mixtures shall be produced in the laboratory using a mix design designated by the Department. The mix design shall be in accordance with 401.04 for a 9.5mm HMA mixture. PG 64-22 asphalt and a mix design for ESAL Category 5 shall be used.

8.1.2 All other aggregates in the mix design shall be the same type and source for both the mixture using the proposed aggregate and the mixture using steel slag as the coarse aggregate. The design binder content and proportion of the aggregates may vary to account for the difference in absorption and specific gravities of the various aggregates.

8.2 Mixture Slabs

8.2.1 Laboratory produced mixtures shall be reheated to $300 \pm 9^{\circ}\text{F}$.

8.2.2 Based on the volume of the mold and the specific gravity of the mixture, the approximate weight of the mixture that would yield 7 to 8 % air voids (V_a) shall be determined.

8.2.3 The mixture shall be placed in a 20 in. by 20 in. by 1 1/2 in. deep square wooden mold.

8.2.4 The mixture shall be compacted using a steel drum mounted on a fork lift.

8.2.5 Once compacted, the slabs shall be thoroughly cooled.

8.2.6 The mixture slab shall be polished a total of 300,000 wheel passes with the Circular Track Polishing Machine.

8.3 Testing and Reporting

8.4.1 The mixture slab shall be tested for the surface texture using the CTM in accordance with ASTM E 2157 and the friction using the DFT in accordance with ASTM E 1911 initially before polishing.

8.4.2 Polishing shall be stopped after 1500, 3600, 9000, 18000, 30000, 45000, 75000, 120000, 165000 and 300000 passes so that the surface texture and friction of the mixture slab may be measured.

8.4.3 The CTM and DFT values are used to determine the International Friction Index (IFI) in accordance with ASTM E 1960. If the IFI value of the mixture slab using the proposed aggregate is equal to or greater than the IFI value for the mixture slab using the steel slag, the Aggregate Producer may request to proceed to Part Two of this procedure.

8.4.4 Copies of the test information shall be sent to the Aggregate Producer and the Department and shall include the following:

1. Coarse aggregate source identification
2. Type of material
3. Ledges of the aggregate, if applicable
4. Date sampled
5. Individual(s) obtaining the sample of coarse aggregate
6. The International Friction Index in accordance with ASTM E 1960

9.0 TEST SECTIONS (PART TWO).

9.1 Test Section Selection

9.1.1 Upon evaluation and approval of the IFI data, a contract will be selected by the Department for placement of the proposed coarse aggregate test section and a control test section using steel slag from an approved source. The contract will have traffic ESAL's equal to or greater than 10,000,000 and have continuous uninterrupted traffic over the test sections.

9.1.2 A 1 mi test section of HMA using the proposed coarse aggregate material shall be placed adjacent to a 1 mi test control section of HMA using steel slag. A mixture blend of Polish Resistant Aggregates or dolomite coarse aggregates with steel slag may be used. Both test sections shall be placed in the same driving lane. The two test sections shall be located between any major intersections on the contract.

9.2 Friction Testing

9.2.1 Each test section will be tested by the Department in accordance with ASTM E 274. A smooth tire in accordance with ASTM E 524 and a 40 mph test speed will be used.

9.2.2 Friction testing will be performed after approximately six months, one year, eighteen months, and two years of exposure to traffic.

10.0 ACCEPTANCE CRITERIA.

- 10.1** If the proposed coarse aggregate HMA friction values are equal to or greater than the control section HMA friction values after two years of exposure to traffic, the proposed coarse aggregate will be approved for HMA surface mixtures for ESAL $\geq 10,000,000$.
- 10.2** The Department will maintain a list of Approved Aggregates including aggregates meeting the requirements outlined herein. The list will include coarse aggregates that are approved for use when air-cooled blast furnace slag, steel furnace slag, or sandstone are required in HMA surface mixtures for contracts with traffic ESAL's equal to or greater than 10,000,000.

The aggregate source and ledge number(s), if applicable, will be placed on the Approved List in the ESAL $\geq 10,000,000$ category.

- 10.3** The aggregate will remain on the Department Approved List unless the material is not performing satisfactorily, as determined by the Department.

**AGGREGATE PRODUCER
ITM 221-12P
WARRANTY BOND**

Know all persons by these presents that we, _____ as principal and _____ as surety, are held and firmly bound unto the State of Indiana (hereinafter referred to as obligee) in the full and just sum of \$ _____, lawful money of the United States of America, for the payment of which, well and truly to be made, we bind ourselves, our heirs, administrators, executors, successors, and assigns, jointly and severally, firmly by these presents.

The condition of the above obligation is that for two (2) years after the date the test section of HMA pavement located on _____, reference point _____ to reference point _____ is
(Beginning Point) (Ending Point)
completed and opened to unrestricted traffic; such warranty is to be in accordance with the Indiana Test Method 221 which is made a part of this bond for warranted test section of HMA pavement. If the principal satisfactorily fulfills the above condition, then this obligation shall be null and void; otherwise such obligation is to remain in full force and effect.

It is agreed that no modifications, omissions, or additions in or to the terms of the ITM 221 or the contract or in or to the plans or specifications shall affect the obligation of the surety on its bond.

In witness whereof, we hereunto set our hands and seal.

Name: _____

Address: _____

By: _____

Signature Surety

Title

(Print or Typed) Surety

State of Indiana, County of _____ SS:

Personally appeared before me,

as surety and acknowledge the executions of the
above bond

this _____ day of _____, 20 _____

By _____

Signature

Notary Public

(Print of Typed) Notary

My Commission Expires _____, 20 _____

(County of Residence)

Name: _____

Address: _____

By: _____

Signature Principle

Title

(Print of Typed) Principal

State of Indiana, County of _____ SS:

Personally appeared before me,

as surety and acknowledge the executions of the
above bond

this _____ day of _____, 20 _____

By _____

Signature

Notary Public

(Print of Typed) Notary

My Commission Expires _____, 20 _____

(County of Residence)